Syllabus for Math 2575, Accelerated Calculus III

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1 Essential Information

We begin with a list of the essential (and mandatory) details for the course:

Course Instructor
Dr. Sean Fitzpatrick
Contact: via email[1]
Office: UH C540
Student hours: Tuesday, Thursday, and Friday 9:30 – 11:30 am and Wednesday by appointment[2].
Any exceptions to this schedule will be announced on Moodle.

Course Website:
via Moodle[3]

Course Textbook
APEX Calculus, by Hartman et al. Available online[4], at no cost.
PDF versions of the book are also available to download, in both colour[5] and black and white[6]. You are free to print these if you would prefer a hard copy.

Class Meetings
Monday, Tuesday, and Thursday at 12:00 pm in Anderson Hall AH177.
First day of class is Thursday, September 5th.

Tutorial Meetings
Tuesday at 1:30 pm in University Hall B730.

Course Description
(As per the Academic Calendar. See Section 5, p. 3 for a more useful description.)

> Calculus of Vector valued functions; Differential calculus of multivariable functions, with applications including optimization. Integral calculus of functions of multiple variables including changes of variables in multiple integrals and different coordinate systems. Calculus of Vector fields; including Greens Theorem, Stokes Theorem, and the Divergence Theorem.

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[2] calendly.com/dr-sean-fitzpatrick
[3] moodle.uleth.ca
[4] opentext.uleth.ca/apex-accelerated/
[5] opentext.uleth.ca/PDF/APEX-2575-colour.pdf
[6] opentext.uleth.ca/PDF/APEX-2575-print.pdf

2 Introduction to Math 2575

Oki, and welcome to the University of Lethbridge. Our University's Blackfoot name is Iniskim, meaning Sacred Buffalo Stone. The University of Lethbridge acknowledges and deeply appreciates the Siksikaitsitapii peoples' connection to their traditional territory. We, as people living and benefiting from Blackfoot Confederacy traditional territory, honour the traditions of people who have cared for this land since time immemorial. We recognize the diverse population of Indigenous Peoples who attend the University of Lethbridge and the contributions these Indigenous Peoples have made in shaping and strengthening the University community in the past, present, and in the future.

Most of your courses, including this one, will be facilitated using the Moodle[1] learning management system. You'll want to spend time as soon as you can familiarizing yourself with your course Moodle pages, and plan to check each one on a daily basis.

Don't hesitate to reach out if you have questions. (See Section 7, p. 5 for details on how to get in touch.) If you have questions that are not related to the course, you can ask those too, and we'll try to answer, or to direct you to someone who can.

There's some great general advice for first year students[2] on the U of L website, including links to Academic Advising and advice on study skills from the Student Success Centre. Other resources can be found on the University's Health and Safety website[3].

Math 2575 will probably look a lot different than your earlier mathematics courses. My goal will be to run a more student-focused course. This means more time spent in class working on problems, discussion with peers, and presenting work. I hope the assessment will feel more student-centred as well.

3 Navigating the Course (a short how-to guide)

Doing well in calculus doesn't require any special talent. It mostly requires good organization, a bit of perserverance, and knowing when to ask for help. (See Section 4, p. 3 for ways to get help.)

We try to keep the workload fairly consistent throughout the semester, which may be unlike other courses that tend to ramp up toward a midterm or big assignment. Figure out what needs to be done each week, set aside time to get it done, and stick to your schedule.

Online homework. Online homework is assigned every week. Your answers are graded automatically by the computer, you get immediate feedback on whether or not your answer is correct, and you usually get unlimited attempts to get a question right if you make a mistake on your first try. (Multiple choice questions are a notable exeception to this policy.)

One of the best things you can do is to start the online homework right away. The exercises will be more useful to you if you work on them at the same time that you are seeing similar problems in class, and/or in the textbook.

Doing the problems early gives you plenty of time to ask for help on the ones you get stuck on, and doing a few each night is much less stressful than leaving them all for an hour before the homework is due.

Class meetings. Our meetings will involve a lot of hands-on work and discussion. You'll be working in groups to solve problems, while I move through the room to answer questions.

How you prepare for these classes probably depends on your personality. Some will find it useful to use class as a way to determine what topics need further study after class. Some will want to prepare before class, because they don't want to be stumped in front of their peers.

Using the textbook. Reading a textbook (especially for a technical subject like mathematics) is a skill you have to learn and practice. A math book can't be read like a novel. It requires some effort and interaction.

Some general suggestions:

[1] `moodle.uleth.ca`
[2] `www.uleth.ca/services-for-students/what-do-i-do-if`
[3] `www.uleth.ca/services-for-students/health-safety`

1. On your first pass through a section, just scan. Skip the explanatory text. Make a note of the significant parts, like definitions and theorems. (You may even want to keep a notebook where you record all the definitions and theorems for yourself.)

2. Next, read the content of the definitions and theorems. Do you understand what they're saying? (On first glance, it's quite likely that you don't.) Now you can read the surrounding explanatory text, to see if it sheds any light.

3. Next, move on to the examples. At this point you might know what the definitions and examples *say*, but this doesn't mean you know how they are *used*. The examples will help illustrate this.

   In the HTML version of the book, the solutions to each example are initially hidden. Write down the problem in the example, and see if you can solve it yourself. Don't worry if you get stuck. Just make a reasonable attempt. Now you're ready to look at the solution, and see how it compares to your attempt. If your results differ from the results in the solution, stop and think. See if you can see where you went wrong.

   Note that many examples have two types of solution: written, and video. You can pick whichever format works better for you.

4. Finally, try some of the exercises. If you find that you're getting most problems in an exercise group correct, it's probably safe to skip ahead to the next exercise group.

   If you find that you're getting them wrong, go back into the section and look for a similar example.

   You can also look for similar problems in the online homework.

4 Getting Help

It is normal — in fact, one might say *expected* — that you will need help with understanding the material at some point during the course. (There's a reason the university pays to keep all these instructors around.)

The easiest place to ask for help is during class! If you're stuck on a problem, and so is your group, just flag me down to ask for help.

Student Hours. Student hours (sometimes called office hours) are times set aside by the course instructor to be available to the students in the course. You can come for help with the course material, to ask more general questions, or simply to introduce yourself. (Occasional visits to faculty offices help ensure that we remember who you are when you find yourself in need of a reference letter.)

You will also be able to use student hours to revise work as needed.

5 Course description

Math 2575 deals with the calculus of vectors, and functions of several variables. We begin with vectors, and vector valued functions, before moving on to several variables, and then finally, combining the two at the end. Just like in one variable, differentiability corresponds to the existence of a linear approximation. We'll then explore multivariable versions of familiar topics, like critical points, extrema, and optimization.

Since Math 1410 is a prerequisite for this course, we can do a few things that don't always make it into a standard calculus course. (At many universities, linear algebra is taken *after* the calculus sequence is complete.) In particular, we'll be able to make better sense of the notion of linear approximation: the linear approximation to a surface is a plane; the linear approximation to a differentiable function is a matrix transformation!

We'll then move on to double and triple integrals, and finally, to vector calculus. Most of what we see in the standard curriculum for vector calculus was developed to deal with problems in Physics, and in particular, electrodynamics. Those of you who have done a course or two in Physics will hopefully be able to make some connections.

6 Assement and grading

I don't expect you to get everything right on your first attempt. Instead, most work that you submit will be initially graded for feedback only. If your work for a problem doesn't meet the standard for successful completion, you will be allowed to revise it and resubmit.

In fact, other than the online homework (which assigns scores automatically), I do not intend to provide numerical scores for your work throughout the semester. The course will be, in a sense, *ungraded*.

There are two primary components to your assessment: quizzes, and homework.

- *Quizzes.*

  A quiz will take place each week in tutorial. You will write individually for 45 minutes, and use the remainder of the tutorial to discuss the quiz problems.

  Each quiz problem will tied to one of 25 *learning outcomes*: see Section 9, p. 6. You will receive feedback, and a "grade" according to the following rubric:

  - **M** (meets expectations): your work demonstrates that you understand the problem, and are capable of doing the necessary calculations. Your work isn't necessarily perfect, but any mistakes are minor.
  - **R** (revision needed): your work demonstrates partial understanding and/or ability, but contains significant errors that need to be corrected to meet expectations.
  - **N** (not yet): you either have not yet attempted a problem for this outcome, or you did not demonstrate sufficient understanding to require revisions.

  If you receive an R grade on a problem, you can upgrade your score to M by submitting a revision. Your revision should identify the mistake that you made, say something about what misunderstanding led to the mistake and how you fixed it, and include a corrected solution. Multiple revisions are permitted.

  If you receive an N grade on a problem, you can request a new problem by visiting my office during student hours (or by appointment). You can expect to spend a bit of time going over the material with me before getting a new problem.

  If you miss a quiz, you can also complete the outcomes you missed in my office, or wait for one of the two make-up quizzes (Oct. 22 and Dec. 9).

- *Homework.*

  Every week, online homework will be assigned via our **WeBWorK** platform. Most questions will allow unlimited attempts, and you will receive full credit once you get a question correct.

  Homework due dates will be flexible. If you need more time, you can ask for it. Note that repeated extension requests may lead to a discussion about time management.

The basic premise of an ungraded course is that you will assess your own effort and performance in the course, and assign yourself a grade. You will meet with me once during the term to discuss your progress in the course, and again during the final exam period, to discuss your overall performance in the course, and to agree on the grade you have earned.

The following table provides a rough guide to determining a letter grade. While I will respect reasonable grade requests, I reserve the right to change any grade requests that are too high (or too low).

Grade	Outcomes	Homework
A	22/25	90%
B	19/25	80%
C	16/25	70%
D	13/25	60%

A grade of F will be assigned if you complete 12 or fewer learning outcomes, or if you complete 15 or fewer outcomes, and less than 50% of the homework, unless you can do a *very* good job of convincing me that you still deserve to pass.

To argue for a grade of A+, you will want to exceed the expectations for an A, and make some other outstanding contribution to the class. This could take the form of being an especially active participant in classroom discussions, or some small extra credit assignment that looks into some theory or application of calculus not covered in class.

Other "decorated" letter grades, like A- or B+, will likely be the result of being just below one of the above thresholds (for a minus grade) or meeting one and exceeding the other (for a plus grade).

Grade meetings. You will be required to meet with me twice during the semester to discuss your progress in the course. The first meeting will be during the week after Thanksgiving: October 15–18. During this meeting, we will discuss how things are going so far, whether you are satisfied with your progress, and whether there are areas for improvement.

We will also determine what learning outcomes (if any) should be included on the "custom quiz" the following week. (This will be a catch-all make-up quiz.)

The second meeting will take place during exam week. I will, of course, know your homework grade, and how many learning outcomes you completed, so I will have a good idea of what grade you are going to request. Nonetheless, you should arrive with a grade in mind, and be prepared to convince me why you deserve that grade.

7 Communication

The following communication channels are available in this course:

1. *Forums.*

   Given the size of this class, we will probably not get much use out of a discussion forum. If there is interest in having this, I can set it up. Otherwise, we should probably be able to take care of most discussion during class time and student hours.

2. *WeBWorK.*

   In our WeBWorK online homework system, there is an "Email Instructor" button you can click to send feedback. This is useful if you think there's an error in the question, or if you've tried it several times and can't figure out why you're wrong. That email comes with a link I can use to jump directly to your version of the question, and see what answers you've tried.

3. *Email.*

   You can email me for questions that aren't related to course content. For example, if you have to miss class, or a test, you can email me to let me know.

8 Course policies (an FAQ)

This section deals with questions about accommodations, missed tests, and other exceptional (yet common) cases.

1. *This week is super busy and I don't think I can finish the homework on time. Can I have an extension?*

   Yes.

2. *What happens if I get sick?*

   I'll do my best to be accommodating of any illness that interrupts your studies. There is no need to provide details of the illness. If you miss a week or more of work, please get in touch to make a plan for catching up. One of the biggest challenges in math is that once you fall behind, it's difficult to catch up on your own.

If you're staying home to avoid spreading illness to others (thank you!), but well enough to attend class, I'll try to provide you with a video link via Teams or Zoom.

3. *What exactly does academic honesty mean?*

   In short, that any work you represent as your own, is your own. Much of your work can be done in groups, but not all of it. I will assume that you have access to a calculator, including online tools that give you step-by-step solutions.

   Use of these tools is acceptable, but take care that you are not overly reliant on them. What is not acceptable is having someone else do your work for you. This includes tutors, classmates, friends, family members, and online "homework help" sites. If you submit work that somebody else did for you, you are committing an academic offence.

   Penalties for academic dishonesty are outlined in the Academic Calendar[1]. Depending on the severity of the offence, penalties for a first offence can range from a grade of zero on an assessment, to an F in the courses. Academic offences are also reported to the Dean of Arts & Sciences. They keep a record of each offence, and students with multiple offences can be subject to supplementary discipline.

4. *Do I need a doctor's note?*

   No. This wastes health care resources and your time. Just email me to say you were sick, and spare me the details. However, if you miss more than one test due to illness, we'll need to meet to discuss how to adjust your grade.

5. *I receive learning accommodations. What arrangements can I make?*

   First, make sure that you have registered with the University's Accessible Learning Centre[2]. No need to let me know: they notify me of every student with accommodations.

   If there are any adjustments I can make to facilitate your learning, please do not hesitate to get in touch with me. All students deserve an equal opportunity to learn. Note that the HTML textbook is designed with accessibility in mind, and should work with screen readers.

6. *Life intervened and I can't keep up this week. What do I do?*

   Send me an email, and I'll help you out as best I can. Book an appointment with me as soon as you feel like you're falling behind and I'll do my best to get you up to speed.

9 Learning outcomes for Math 2575

This page outlines the list of competencies each student is expected to achieve in Math 2575. The number following each outcome below indicates the corresponding textbook section. The online homework, tutorial assignments, and tests are all designed to help you achieve these outcomes.

By the end of the course, you should be able to:

A. Chapter 13: Vector-Valued Functions

   1) Apply the algebra of vectors to vector-valued functions (13.1)
   2) Apply concepts of calculus (limit, derivative, antiderivative) to vector-valued functions (13.2)
   3) Use the derivative of a vector-valued function to find tangent lines (13.2)
   4) Use vector-valued functions to describe motion (velocity, acceleration, etc.) (13.3)
   5) Compute the unit tangent and normal vectors and apply them to acceleration (13.4)
   6) Compute the curvature of a vector-valued function (13.5)

B. Chapter 14: Differential Calculus in Several Variables

[1] `www.uleth.ca/policy/resources/student-discipline-policy-academic-offences-undergraduate-students`
[2] `www.ulethbridge.ca/accessible-learning-centre`

1) Determine the differentiability of a function of several variables (14.1)
2) Compute and apply the total differential of a function of several variables (14.1)
3) Use the chain rule for functions of several variables (14.2)
4) Use the gradient vector to compute normal vectors and directional derivatives (14.3)
5) Determine the equation of the tangent plane to a surface in three dimensions (14.4)
6) Find and classify critical points for functions of two variables (14.5)
7) Determine the absolute maximum and minimum values of a function subject to a constraint (14.5, 14.7)

C. Chapter 15: Integral Calculus in Several Variables

1) Understand the definition and properties of a double integral (15.1, 15.2)
2) Evaluate double and triple integrals as iterated integrals (15.1,15.6)
3) Change the order of integration in a double or triple integral (15.1, 15.2,15.6)
4) Use polar, cylindrical and spherical coordinates to evaluate an integral (15.3, 15.7)
5) Use a general change of variables to evaluate a double or triple integral (15.8)

D. Chapter 16: Vector Calculus

1) Set up and evaluate line integrals of scalar and vector fields (15.1, 15.3)
2) Compute the divergence and curl of a vector field, and interpret their meaning (15.2)
3) Apply the Fundamental Theorem of Calculus for line integrals (15.3)
4) Use Green's Theorem to evaluate double integrals and line integrals in the plane (15.4)
5) Describe a surface in space using parametric equations (15.5)
6) Set up and evaluate the integral of a vector field over a surface (15.6)
7) Understand and apply Stokes' Theorem and the Divergence Theorem (15.7)

10 Course schedule

We will follow the schedule below as closely as possible. Some variations will inevitably occur; see Moodle for the most up-to-date information. In-class problems will be chosen from the indicated sections.

Usually, *Monday* and *Thursday* classes will involve problem solving, and sometimes a short mini-lecture. *Tuesday* classes are immediately followed by the tutorial, so we'll do more of a question-and-answer format, unless we need to make up for a holiday Monday.

Table 10.1 Schedule for Fall 2024

Week	Monday	Tuesday	Tutorial	Thursday
			Welcome	
Sep. 9-12	13.1,13.2	Q&A	Vector review	13.3
Sep. 16-19	13.4	Q&A	Quiz 1 (13.1-13.3)	13.5
Sep. 23-26	14.1	Q&A	Quiz 2 (13.4-13.5)	14.2
Oct. 1-3	Holiday	14.3	Quiz 3 (14.1-14.2)	14.4
Oct. 7-10	14.5	Q&A	Quiz 4 (14.3-14.4)	14.7
Oct. 15-17	Holiday	Q&A	Quiz 5 (14.5,14.7)	14.6
Oct. 21-24	15.1,15.2	Q&A	Custom Quiz	15.3
Oct. 28-31	15.6	Q&A	Quiz 6 (15.1-15.3)	15.7
Nov. 4-7	15.8	Q&A	Quiz 7 (15.6-15.7)	16.2
Nov. 18-21	16.1	Q&A	Quiz 8 (15.8, 16.2)	16.3
Nov. 25-28	16.4	Q&A	Quiz 9 (16.1, 16.3)	16.5
Dec. 2-5	16.6	Q&A	Quiz 10 (16.4, 16.5)	16.7
Dec. 9	"Final"			

The "Custom Quiz" on October 22 will be an opportunity for you to revise (or attempt) any of the learning outcomes from Chapters 13 or 14 that you did not already complete.

The "Final" during the last class on December 9 will include learning outcomes for 16.6 and 16.7, and any outstanding learning outcomes from Chapters 15 and 16. (Bearing in mind that we have only 50 minutes.)